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ABSTRACT

This study attempts to determine if individual differences in multitask performance are due in part to the cognitive competence (i.e., the consistent, rule-based strategy) the subject brings to the task. A battery of learning (discrimination shift, transposition, incidental learning and paired-associate learning), cognitive-developmental (seriation, conservation of amount and transitivity) and psychometric (Raven's Colored Progressive Matrices) measures were administered to 120 children from kindergarten and second grades. Similarities and differences underlying children's problem-solving performance during this time were then assessed. Subjects were categorized into one of three performance levels for the criterion tasks, e.g., conserver/nonconserver/inconsistent conserver. Overall performance, as a function of age, sex and the respective performance categories, was assessed via canonical correlations and multiple regression analyses. The results indicated that performance on reversal shift and conservation alone predicted overall multitask performance ($p<001$). Moreover, there appeared to be a trend toward improved overall performance from nonperformers through inconsistent performers to perfect performers on the conservation task. The results suggest that while both reversal and conservation are indices of mediation, albeit rule-based strategies, conservation is a far more powerful predictor of overall task performance. These results suggest the feasibility of using multitask, multidomain research to better understand the nature of the development of cognition in children. (Author/MS)

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INTERTASK CORRESPONDENCE IN THE 5 TO 7 SHIFT:

A QUESTION OF COMPETENCE VS. PERFORMANCE

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Much research on learning task performance has focused on the fairly basic and important change in the character of learning which appears to begin at about age 5 and is relatively completed at about age 7. This period of time has been labeled by Sheldon White (1965) as the 5 to 7 shift.

The transition to improved cognitive ability that takes place during this age span has been attributed to various formal causative factors. For example, the Piagetian school states that the onset of concrete operations induces the improved cognitive ability. Learning theorists such as the Kendlers, however, attest that language increases its influence on learning at this time, and children learn to verbally mediate. Given these explanatory notions what has emerged is a discussion of competence vs. performance, with competences being represented by such global strategies as mediation and conservation which must be inferred from performance, or actual task response. The present study was designed to investigate the relationship between competence and performance by attempting to determine if individual differences in multitask performance were due in part to the cognitive competence (i.e., the consistent, rule-based strategy) the subject brings to the task.

To accomplish this the specific task performance and intertask correspondences of 120 children from the kindergarten and second grades were examined. Similarities and differences in performance were examined for the following task breakdowns:

Learning tasks - which included discrimination reversal shift, downward two-choice transposition, paired-associates and incidental learning

Cognitive-developmental tasks - which included transitivity, seriation, and conservation of amount

and a

Psychometric assessment which consisted in the Raven's Colored Progressive Matrices.

Correlations and analysis of variance were performed to assess the nature of intertask correspondences for the respective age, sex and performance characteristic subgroups.

The analyses of single task performance showed that in all cases the second grade subjects performed significantly better than the kindergarten subjects. These statistics confirmed that subjects in this sample performed in ways comparable to previously reported findings (e.g., Kuenne, 1946; Kendler, 1962; Flavell, 1963). Correlations of intertask relationships also were similar to previous studies, i.e., tasks sharing similar instructional demands or contents had high intercorrelations while those with dissimilar dem-ands or contents had low intercorrelations. These findings held regardless of the theoretical origins of the tasks. In some cases learning and cognitive-developmental tasks were correlated, e.g., conservation and reversal shift performance were significantly correlated. In other cases learning tasks did not correlate with each other, e.g., the traditional indices of mediation (tran position and reversal shift) were not significantly correlated. These results suggest the necessity of equating both stimulus and response demands even within a theoretical domain, to adequately reflect cognitive processes or order their emergence hierarchically.

Following these initial analyses, subjects were classified along stringent task performance criteria as either performers, inconsistent performers or nonperformers for the following tasks:

conservation, seriation, transposition, reversal shift and Raven's Matrices.

The Raven's measure consisted in classifying subjects based on the consistent use of a particular strategy to solve the varying levels of difficulty presented by the matrices. The other individual difference classifications were relatively straightforward, e.g., reversers were children who performed 10/10 reversal choices on the test phase of discrimination learning, inconsistent reversers were children who performed some reversal shifts and some nonreversals, and nonreversers were those children who performed 10/10 nonreversal choices on the test phase.

Once these individual differences in performance were established, canonical correlations were performed to assess the effect of age, sex and the performance classifications in predicting multitask performance. These canonical correlations indicated that predictability of multitask performance was possible only in the cases of conservation and reversal shift performance categories. However, only conservation performance predicted significantly different multitask response patterns for all three levels of conservation ability. Conservation was therefore a more robust predictor of performance than any other criterial task, including reversal shift (also known as mediation). Conservation levels predicted seriation, the incidental learning central and incidental recall measures, reversal shift performance and strategy-based performance on the Raven's matrices.

One of the interesting results of the research was that children classified as conservers were also seriators, reversers, and used strategies to solve the Raven's. They also showed a significantly superior level of overall performance than either the nonconservers (who showed the poorest overall performance) or t' inconsistent conservers. The subjects classified as conservers seemed to possess an effective approach to solving diverse tasks as they were classified as perfect performers on all criterial tasks except for transposition. Overall, they seemed to possess some cognitive rules for task solution which were highly effective and integrated.

Flavell and Wohlwill (1969) stated that as children mature cognitively, i.e., approach concrete operations, their behavior under specifiable cognitive demands increasingly reflects a consistent strategy indicative of rule-based performance. This suggests that overall competence in multiple domains, e.g., those domains tapped or tested by cognitive-developmental and learning tasks, are interrelated in some meaningful way and emerge at different points in time. As children stablize at the next higher cognitive level their overall cognitive abilities coalesce and become functionally integrated. The skills in the actual transition process are diverse, nonintegrated and therefore less efficient in problem solving. These factors may account for the performance increments seen from nonconservers to inconsistent conservers to conservers in the present research. Since reversal shift performance did not show this same increment, it does not appear to be the prime competence underlying learning task performance.

This statement brings us to another interesting aspect of the results. I had hoped to prove with this research that mediation and conservation would be equally effective predictors of multiple task performance. It seemed an intuitively compelling theory given my background in both learning and Piagetian theory. However, it so happened that not only was reversal shift performance not as effective a predictor as conservation in predicting cognitive task performance, but it also was not as effective as conservation in predicting learning task performance. This suggests that mediation per se is not the primary competence underlying the improved cognition of the 5-7 shift. Moreover, transposition and reversal shift performance, both traditional indices of mediation for learning theorists, were not significantly correlated. It therefore appears at least reasonable to question the use of both discrimination shift and transposition as equivalent indices of mediation.

The multivariate analyses did indicate that reversal shifts could predict multitask performance. However, they could not differentiate between levels of performance in transition, while the conservation levels of performance could. This suggests that while conservation and mediation are independent skills, they both exercise significant effects on individual patterns of learning. However, conservation is the more powerful predictor of overall performance.

It therefore appears that mediation provides a yardstick of cognitive ability but does not effectively distinguish among subjects in terms of rate of progression through levels of cognitive competence. It is rather

the achievement of conservation skills that provides the lowest boundary for a qualitative change in cognitive competence. Reversal shifts and conservation may tap similar skills that are ontogenetic in origin, such as brain laterality, planfulness and reversibility as suggested by White (1965). However, reversal shifts seem to indicate the presence of a probability of a particular response, while conservation performance indicates consistent multitask use of a qualitatively different cognitive competence. It is for this reason that conservation appears to be a better predictor of learning task performance than the standard mediational indices.

The results of this study may be interpreted as suggesting that learning and cognitive-developmental tasks have common underlying skills if one controls for task contents and instructional demands. It is possible that these tasks differentially access emergent subskills necessary to produce the qualitative change in cognition occurring at approximately 7 years of age. It therefore appears that a series of relatively independent strategies are involved in children's learning and problem-solving ability. These strategies become more efficient and integrated as children mature and therefore produce the observed developmental improvement in multitask performance.

These findings demonstrate the utility of transcending model or paradigm tenets and considering both cognitive-developmental parameters and specific task performance in investigating children's cognitive behavior. This theoretical position allows for activity on the part of both the organism and environment, namely, the organism uses strategies to assimilate new situations; the environment acts by means of presenting conditions (such as task contents and instructional demands).

Learning, in this framework, is the result of the application of cognitive structures to informational input from the environment. The role of presenting conditions, reinforcement contingencies, etc., is to determine the information available from the environment by instituting attentional sets as mediational aids, evoking the proper processing channels, or both.

These results suggest the feasibility of using multitask, multidomain research to better understand the nature of the development of cognition in children.